User's Manual

E1/E20 Emulator, E2 Emulator Lite

Additional Document for User's Manual (Notes on Connection of RL78)

Supported Devices:
RL78 Family
RL78/G10

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Terminology

Some specific words used in this user's manual are defined below.

Host machine
This means a personal computer used to control the emulator.

User system
This means a user's application system in which the MCU to be debugged is used.

User program
This means the program to be debugged.

Programming software
In this document, this indicates Renesas Flash Programmer that can be used with the E1, E20, or E2 Lite.

"#" at the end of a pin name (signal name)
"#" at the end of a pin name (signal name) indicates that the pin (signal) is active low (e.g., RESET#).

1. Overview

1.1. Overview of E1/E20 Emulator and E2 Emulator Lite

In this document, we describe ‘E1 Emulator’ as ’E1’, ‘E20 Emulator’ as ’E20’ and ‘E2 Emulator Lite’ as ‘E2 Lite’.
The E1, E20, and E2 Lite are on-chip debugging emulators for Renesas' mainstream MCUs.
The E1 and E2 Lite are highly affordable development tools providing basic debugging functions. The E20 is a development tool allowing sophisticated debugging through enhanced functions such as tracing and RAM monitoring as well as the basic debugging functions of the E1 and E2 Lite. The E1/E20/E2 Lite can also serve as a Flash Programmer.

1.2. Note on Using E20

To use the large trace function and the real-time RAM monitoring function, which are the primary features of the E20, the target MCU must be equipped with a pin for outputting trace information.
The available functions are equivalent to those of the E1/E2 Lite (only the internal trace function in the MCU and memory reference and modification during execution).
The power supply function from the E20 is not supported.

1.3. Configuration of E1/E20/E2 Lite Manuals

The E1/E20/E2 Lite manuals consist of multiple parts: the E1/E20 Emulator User's Manual, the E2 Emulator Lite User's Manual, and the additional documents for the user's manual for each MCU.
Be sure to read each part before using the E1/E20/E2 Lite.

(1) E1/E20 Emulator User’s Manual

The E1/E20 emulator user’s manual has the following contents:

- Components of the E1/E20
- Hardware specifications of the E1/E20
- Connection to the E1/E20 and the host machine and user system

(2) E2 Emulator Lite User’s Manual

The E2 Emulator Lite user’s manual has the following contents:

- Components of the E2 Lite
- Hardware specifications of the E2 Lite
- Connection to the E2 Lite and the host machine and user system

(3) E1/E20 Emulator, E2 Emulator Lite Additional Document for User's Manual (Notes on Connection of RL78)

The E1/E20 Emulator, E2 Emulator Lite Additional Document for User's Manual (Note on Connection for RL78) describes information necessary for hardware design such as connection examples, interface circuits, and notes on using the emulator.

(4) User’s manual and help for the emulator debugger

The user’s manual and help for the emulator debugger describe the functions of the E1/E20 emulator debugger and the operating instructions.
Refer to the following for E1/E20.

- CS+ Integrated Development Environment User's Manual: RL78 Debug
- Help for e2 studio

Refer to the following for E2 Lite.

- Help for e2 studio

When using C-SPY made by IAR Systems, also refer to "IAR C-SPY Hardware Debugger System User Guide issued by IAR Systems" published by IAR Systems.

1.4. Supported Devices

Table 1-1 Supported Device List

Item	Description
Target MCUs	RL78 family (RL78-S1 core)*1
	RL78/G1x: RL78/G10

*1 For details on the RL78-S1 core, refer to "RL78 Family User's Manual: Software".
*2 When using the RL78/G10, refer to "E1/E20 Emulator, E2 Emulator Lite Additional Document for User's Manual (Notes on Connecting RL78)".

Table 1-2 Debugging Function List

Item		Type of the RL78 Core	Description
		RL78-S1	
Memory reference or change during program execution			
Pseudo-real-time RAM monitor (RRM)		Supported	CPU is used when monitoring
Dynamic Memory Modification (DMM)		Supported	CPU is used when changing
Event		Max. 2 points	Can be used for a hardware break
Break	Software break	Not supported	
	Hardware break	Supported	Execution address
	Forced break	Supported	
Trace	Acquired information	Not supported	
	Start event	Not supported	
	End event	Not supported	
Execution time measurement	Measurement item	Supported	Between start and stop of user program execution
	Performance	Supported	Resolution: 100 µs Maximum measurement time: Approx. 119 hours 18 minutes
Hot plug-in		Not supported	
Coverage measurement		Not supported	

2. Designing the User System

2.1. Connecting the E1/E20/E2 Lite to the User System

To connect the E1/E20/E2 Lite to the user system, a connector for the user system interface cable must be mounted on the user system.
When designing the user system, read this section of this manual and the hardware manual for the MCU in use.

2.2. Installing the Connector on the User System

Table 2-1 shows the recommended connectors for the E1/E20/E2 Lite.

Table 2-1 Recommended Connectors

Connector	Type Number	Manufacturer	Specifications
14-pin connector	7614-6002	3M Japan Limited	14-pin straight type (Japan)
	2514-6002	3M Limited	14-pin straight type (other countries)

* Connection to the 38-pin connector of the E20 is not supported. To use the E20, use the 38-pin to 14-pin conversion adapter that comes with the E20 for connection to the 14-pin connector on the user system.

2.2.1. Connecting the User System Interface Cable to the 14-Pin Connector

Figure 2-1 shows an example of connection between a user system interface cable of the 14-pin type and the E1/E2 Lite.
Figure 2-2 shows an example of connection between the cable with the 14-pin connector and the E20 via the 38-pin to 14-pin conversion adapter.

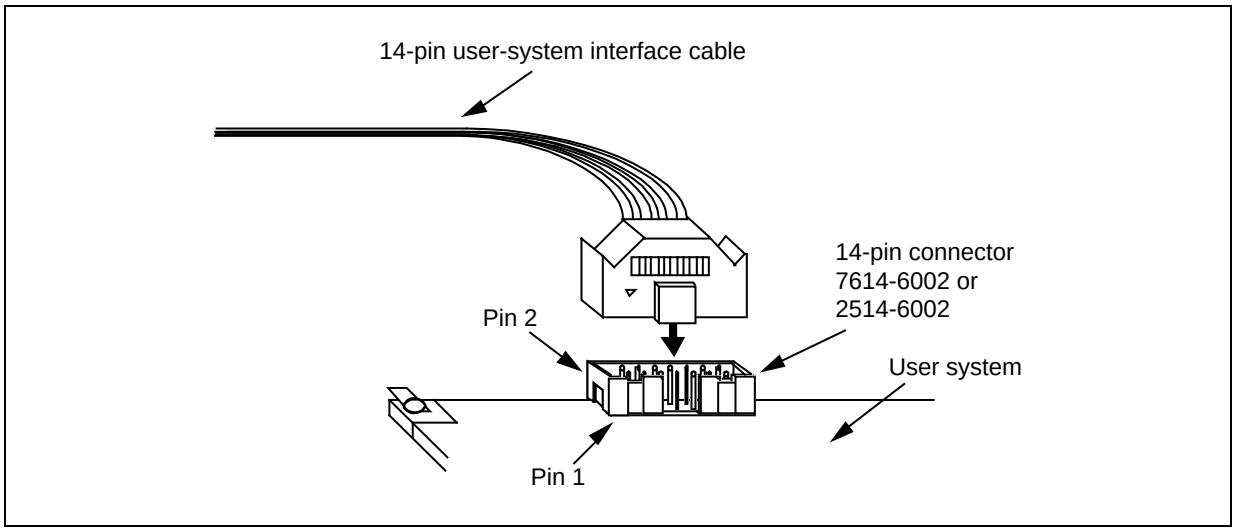


Figure 2-1 Connecting the User System Interface Cable to the 14-Pin Connector of the E1/E2 Lite

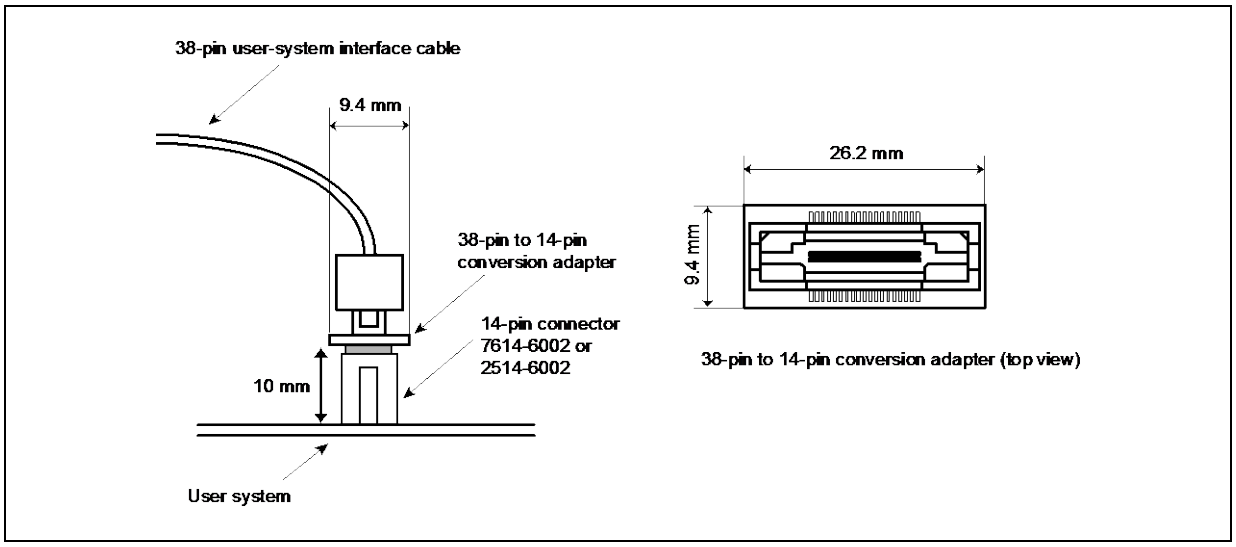
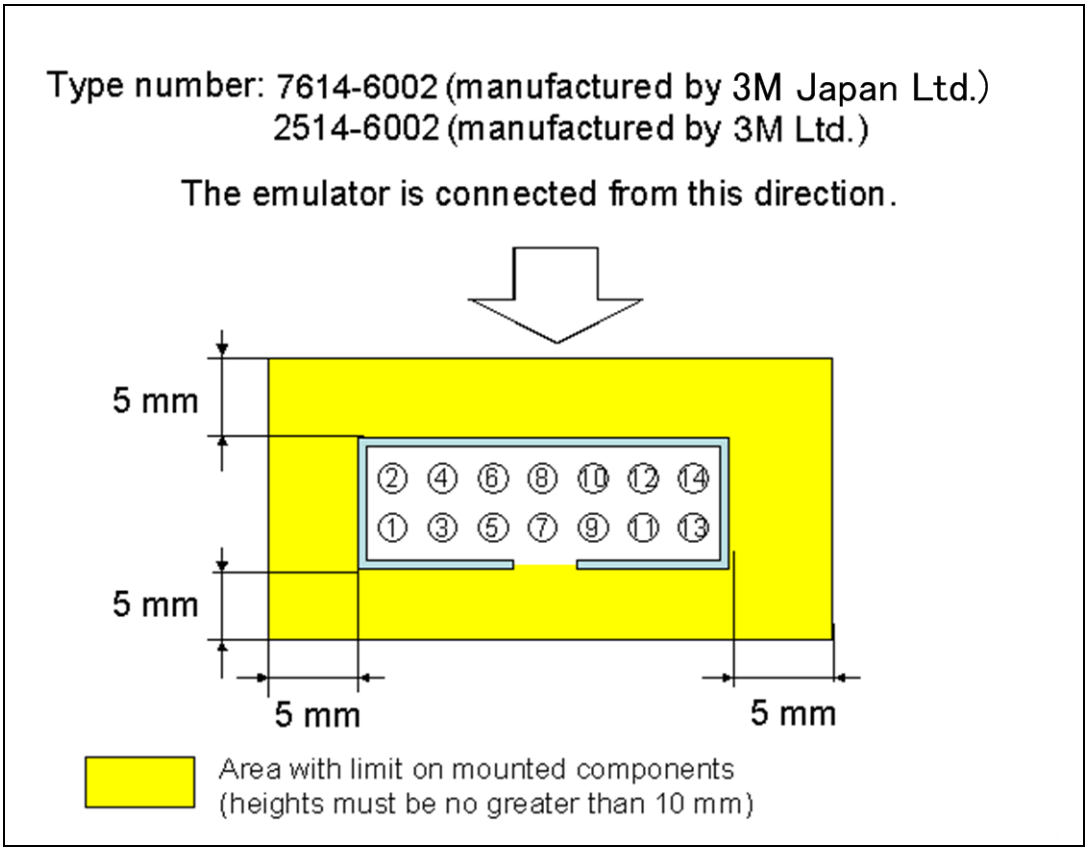


Figure 2-2 Connecting the User System Interface Cable to the 14-Pin Connector of the E20 Emulator

CAUTION

Limit to the height on connector periphery:

For a case where the R0E000200CKA00 is used for connecting the E20 to a 14-pin connector, do not mount other components with a height of 10 mm or more within 5 mm of the connector on the user system.

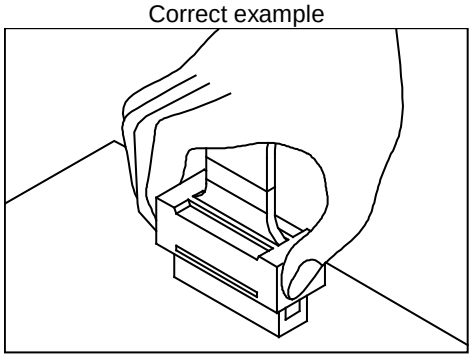

Type number: 7614-6002 (manufactured by 3M Japan Ltd.)
2514-6002 (manufactured by 3M Ltd.)
The emulator is connected from this direction.
5 mm
5 mm
② ④ ⑥ ⑧ ⑩ ⑫ ⑭
① ③ ⑤ ⑦ ⑨ ⑪ ⑬
5 mm
5 mm
Area with limit on mounted components
(heights must be no greater than 10 mm)

CAUTION

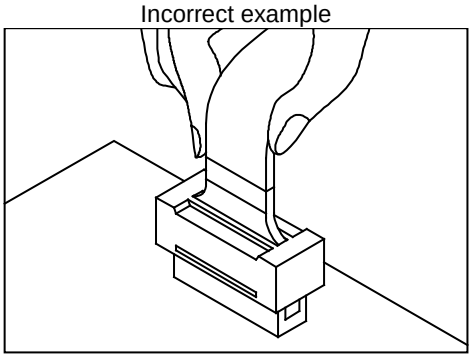
Notes on connector insertion and removal:

When connecting or disconnecting the user system interface cable and the emulator or user system, grasp the connector cover at the end of the cable. Pulling the cable itself will damage the wiring.
Also, be aware that the user system interface cable has the direction in which it must be inserted. If the cable is connected in the wrong direction, it may be damaged.

Correct example



Incorrect example



2.3. Pin Assignments of the Connector on the User System

2.3.1. 14-pin Connector Specifications

Figure 2-3 shows the specifications of the 14-pin connector.
Table 2-2 on the following pages shows the pin assignments of the 14-pin connector.

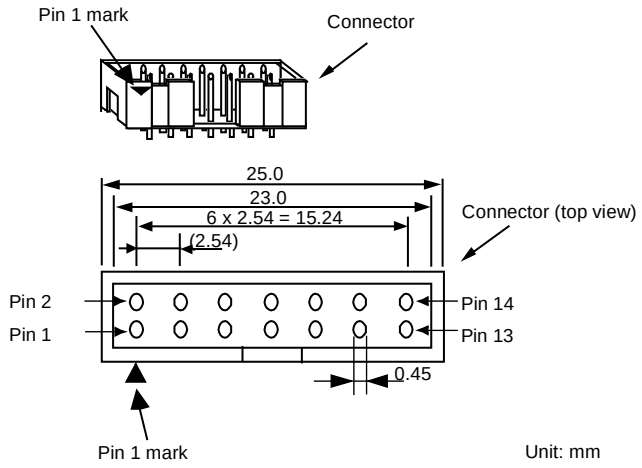


Figure 2-3 Emulator Connector Specifications (14 Pins)

Table 2-2 14-Pin Connector Pin Assignments

Pin No.	RL78/G10 Signal *1 *2	Direction *3	Note
1	R.F.U *6	—	
2	GND *4	—	
3	R.F.U *6	—	
4	RSTPU	Input	This pin is used to pull up the reset line.
5	TOOL0	I/O	This pin is used to transmit command/data to the target device.
6	RESET_IN	Output	This pin is used to input a reset signal from the user system.
7	R.F.U *6	—	
8	VDD	—	
9	EMVDD *7	—	
10	RESET_OUT *5	Input	This pin is used to output a reset signal to the target device.
11	R.F.U *6	—	
12	GND *4	—	
13	RESET_OUT *5	Input	This pin is used to output a reset signal to the target device.
14	GND *4	—	

*1 For details on the programming software, refer to
http://www.renesas.com/products/tools/flash_prom_programming/

*2 These are the names of the MCU pins at the time the E1/E20/E2 Lite is connected (i.e. during debugging).

*3 Input to or output from the user system.

*4 Securely connect pins 2, 12, and 14 of the connector to GND of the user system. These pins are used for electrical grounding as well as for monitoring of connection with the user system by the E1/E20/E2 Lite.

*5 Securely connect both pin 10 and pin 13.

*6 This pin is reserved. Perform the open processing.

*7 Connect VDD.

2.4. Recommended Circuit between the Connector and the MCU

This section shows recommended circuits for connection between the connector and the MCU when the E1/E20/E2 Lite is in use. For processing of signals, refer to section 2.5, Notes on Connection.

2.4.1. Connection between the 14-pin Connector and the RL78 Family MCUs

Figure 2-4 shows a recommended circuit for connection between the 14-pin connector and the RL78 family MCUs.

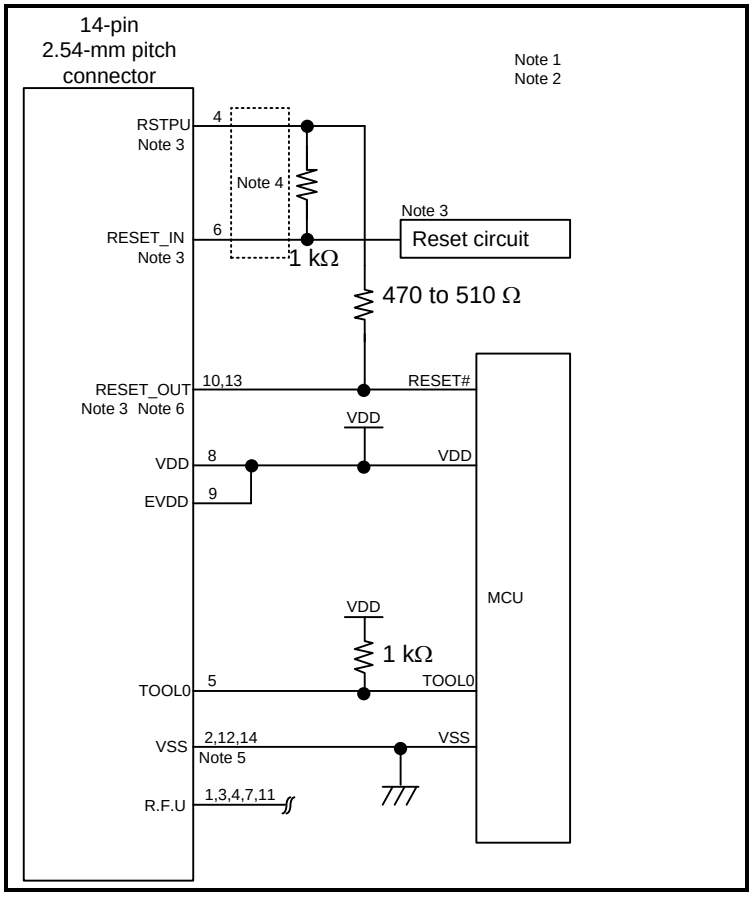


Figure 2-4 Example of Connection between the 14-Pin Connector and the RL78 Family MCUs

Notes:
1. The circuits and resistance values listed are recommended but not guaranteed. Determine the circuit design and resistance values by taking into account the specifications of the target device and noise. For flash programming for mass production, perform sufficient evaluation about whether the specifications of the target device are satisfied.
2. For processing of pins not used by the E1/E20/E2 Lite, refer to the hardware manual for the device.
3. The recommended circuit for the RESET# pin differs depending on whether the multiplexed functions are used. For details on how to handle the RESET# pin, also refer to section 2.5, Notes on Connection.
4. The RESET_IN pin is used only in debugging. It is not necessary in flash programming by the programming software.
5. Securely connect pins 2, 12, and 14 of the connection to GND of the user system. These pins are used for electrical grounding as well as for monitoring of connection with the user system by the E1/E20/E2 Lite.
6. Securely connect both pin 10 and pin 13.

2.5. Notes on Connection

Wiring patterns between the connector and the MCU must be as short as possible (within 50 mm is recommended). Do not connect the signal lines between the connector and MCU to other signal lines on the board.
For the handling of pins while the E1/E20/E2 Lite is not in use, refer to the hardware manual for the MCU.

2.5.1. RESET# Pin

The RESET# pin is used by the E1/E20/E2 Lite to monitor the pin state and issue a reset to the device. Therefore, a reset signal on the user system is once input to the E1/E20/E2 Lite where it is controlled by masking and then output to the target device. Connection examples of the RESET# pin section are shown in Table 2-3, Figure 2-5, and Figure 2-6.
When flash programming by the programming software is to be performed, the RESET# pin should be designed so that the reset signal on the user system does not conflict with the reset signal from the E1/E20/E2 Lite.

Table 2-3 Connection Examples According to the Reset Circuit on the User System

No.	Target Device	Case	Reference
1	RL78/G10	There is a reset circuit on the user system.	Figure 2-5
2		There is no reset circuit on the user system. (when using the P125/KR1 function which is multiplexed with RESET#)	Figure 2-6

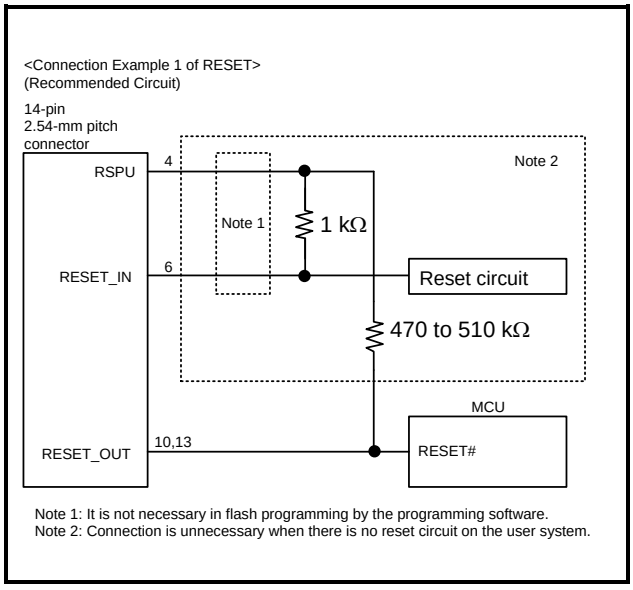


Figure 2-5 Connection Example 1 of RESET#

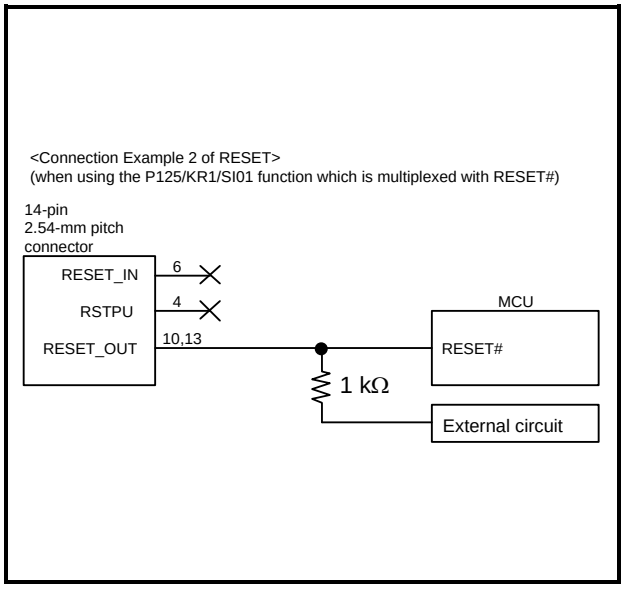


Figure 2-6 Connection Example 2 of RESET#

- Do not install capacitors, series resistors, or filters on signal lines; if attempted, correct communication may not be established.
- The circuits and resistance values listed are recommended but not guaranteed. Determine the circuit design and resistance values by taking into account the specifications of the target device and noise.
- Securely connect pins 2, 12, and 14 to GND of the user system. These pins are used for electrical grounding as well as for monitoring of connection with the user system by the E1/E20/E2 Lite.
- Securely connect both pin 10 and pin 13.

2.5.2. TOOL0 Pin

The E1/E20/E2 Lite uses the TOOL0 pin. Any functions that are multiplexed on this pin are not available. Pull up the signals of the TOOL0 pin at 1 kΩ and do not arrange these signal lines in parallel with or across other high-speed signal lines.

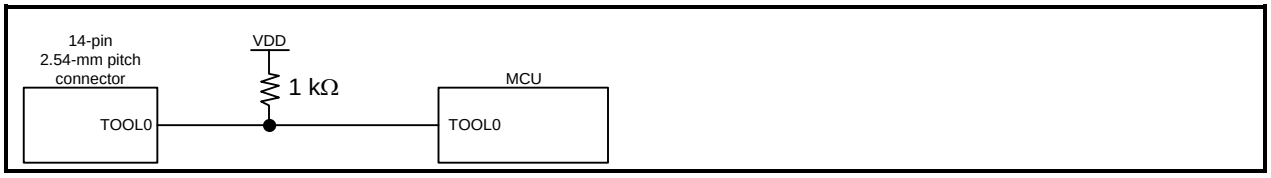


Figure 2-7 Connection Example of the TOOL0 Pin

Do not use adjacent resistors for pull-up of the TOOL0 pin because they may affect or may be affected from other pins.
Do not install capacitors, series resistors, or filters on signal lines; if attempted, correct communication may not be established.

2.5.3. GND

The pins of the connector marked "GND" must be at the same ground level as the VSS pin of the MCU.

2.5.4. VDD

Connect the VDD of the connector to the VDD (power supply) of the user system.
Use the emulator within the power supply voltage of 1.8 V to 5.5 V and within the operating voltage range of the MCU.
When power is supplied to the user system from other than the emulator, the E1/E20/E2 Lite consumes the power supply for the last output and first input buffers of the emulator.

E1:	3.3 V: approximately 20 mA,	5.0 V: approximately 40 mA
E20:	3.3 V: approximately 40 mA,	5.0 V: approximately 100 mA
E2 Lite:	3.3 V: approximately 20 mA,	5.0 V: approximately 40 mA

The E1/E2 Lite can supply power to a simple evaluation system.

E1: Can supply power of 3.3 V or 5.0 V, up to 200 mA.
E2 Lite: Can supply power of 3.3 V, up to 200 mA.

When using the power supply function of the E1/E2 Lite, check the voltage supplied to the user system. Particularly, when the 5.0-V supply option is selected, the voltage may drop 0.5 V or more since it depends on the USB VBUS power-supply voltage.

The on-chip debugging circuit in the device operates during on-chip debugging. Therefore current consumption of the device increases. When evaluating current consumption of the device, do not connect the E1/E20/E2 Lite.

Power supply from the E1/E2 Lite depends on the quality of the USB power supply of the host machine, and as such, precision is not guaranteed. When writing a program that requires reliability, do not use the power supply function of the E1/E2 Lite. Use a stable, separate power supply for the user system. When writing a program for mass production processes, use the Renesas Flash Programmer.
For details on the programming software, refer to:
http://www.renesas.com/products/tools/flash_prom_programming/

WARNING

Warning for Turning the Power On/Off:

When supplying power, ensure that there are no shorts between VDD and GND. Only connect the E1/E20/E2 Lite after confirming that there are no mismatches of alignment on the user system port connector. Incorrect connection will result in the host machine, the E1/E20/E2 Lite, and the user system emitting smoke or catching fire.

2.6. Internal Circuits of the Emulator

2.6.1. Internal Circuits of the E1 (when the RL78 Family is Connected)

Figure 2-8 shows the internal circuits of the E1 with the RL78 family connected.

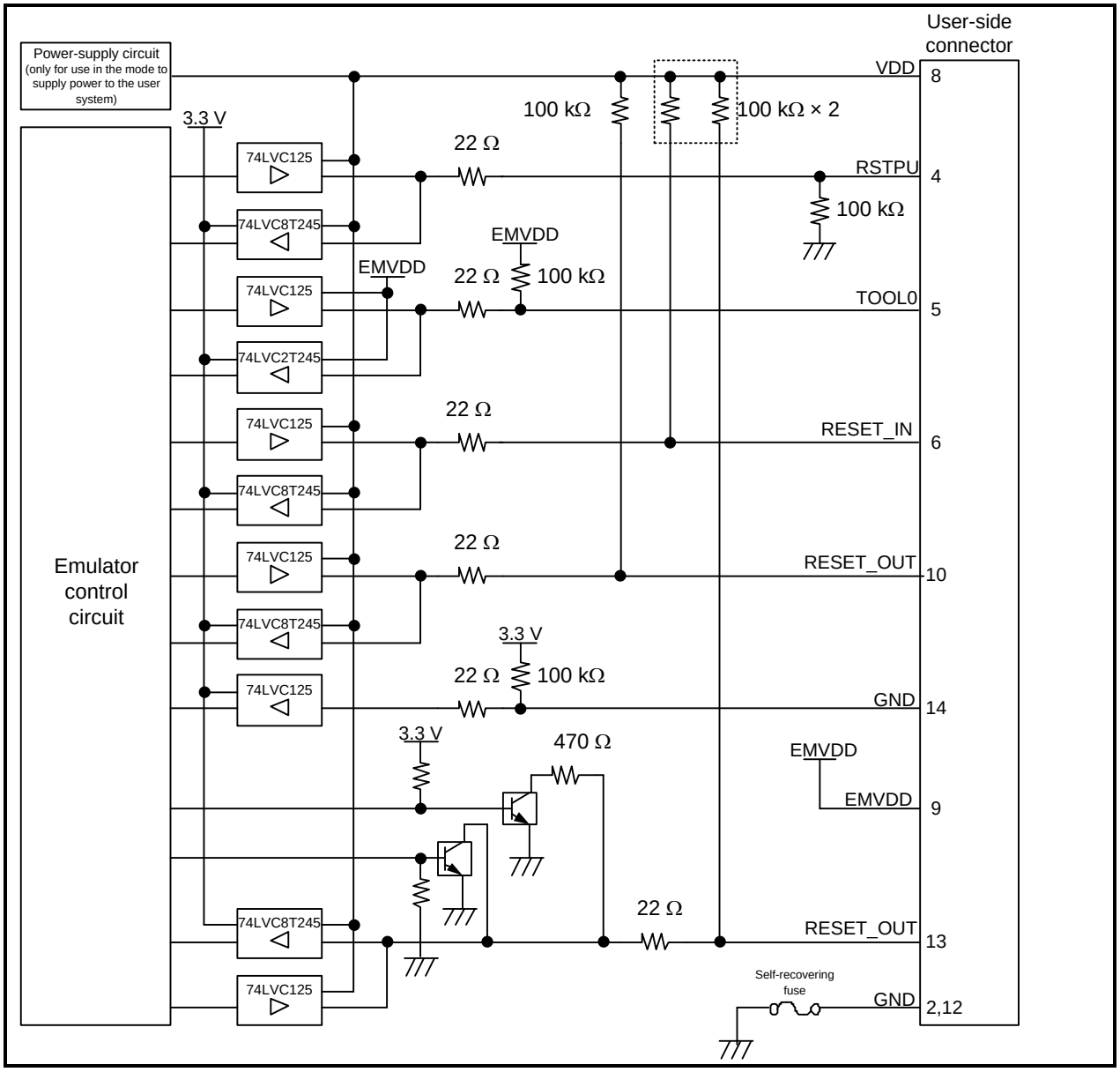


Figure 2-8 Internal Circuit of the E1 (when the RL78 Family is Connected)

2.6.2. Internal Circuits of the E20 (when the RL78 Family is Connected)

Figure 2-9 shows the internal circuits of the E20 with the RL78 family connected.

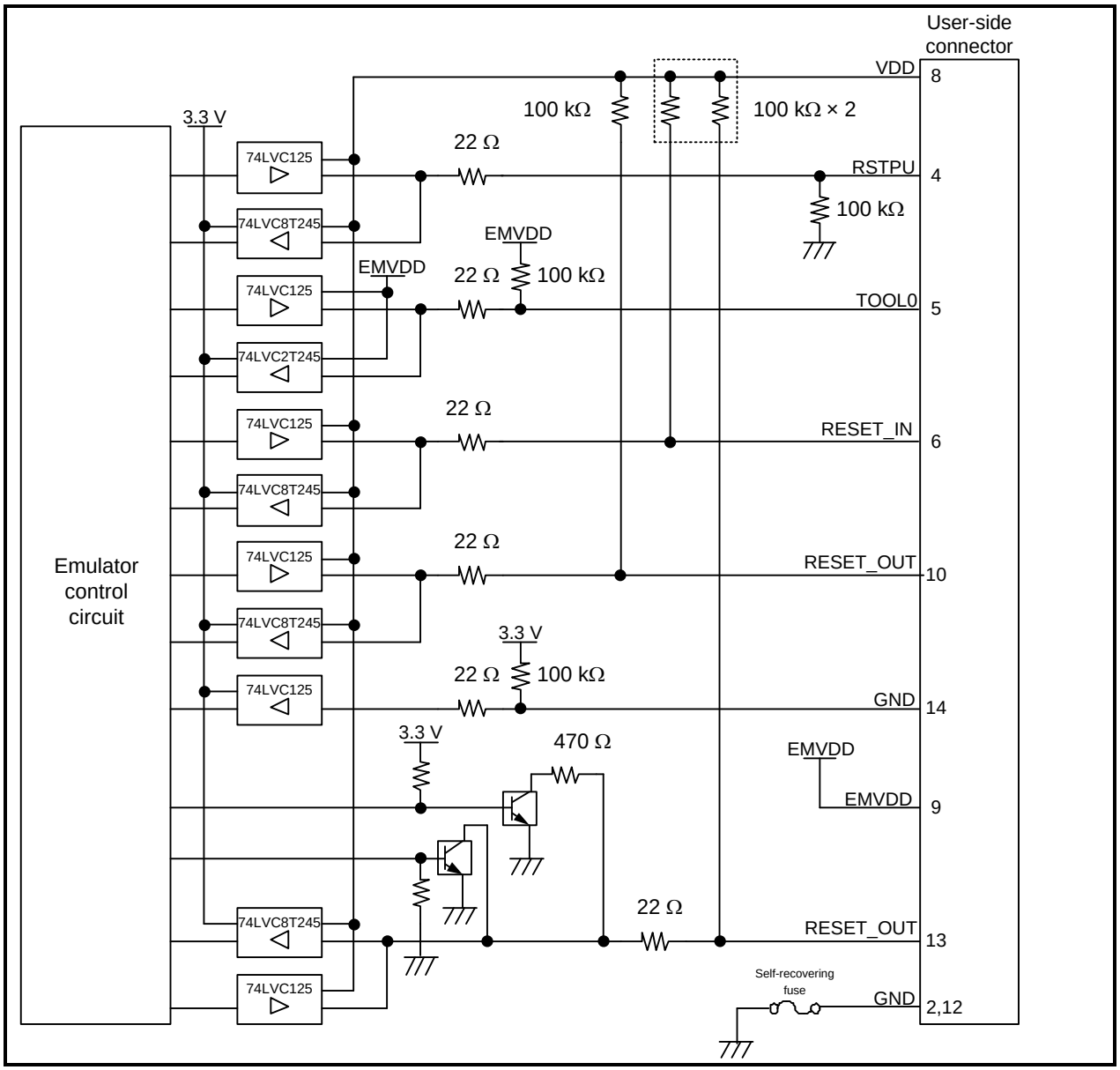


Figure 2-9 Internal Circuits of the E20 (when the RL78 Family is Connected)

2.6.3. Internal Circuits of the E2 Lite (when the RL78 Family is Connected)

Figure 2-10 shows the internal circuits of the E2 Lite with the RL78 family connected.

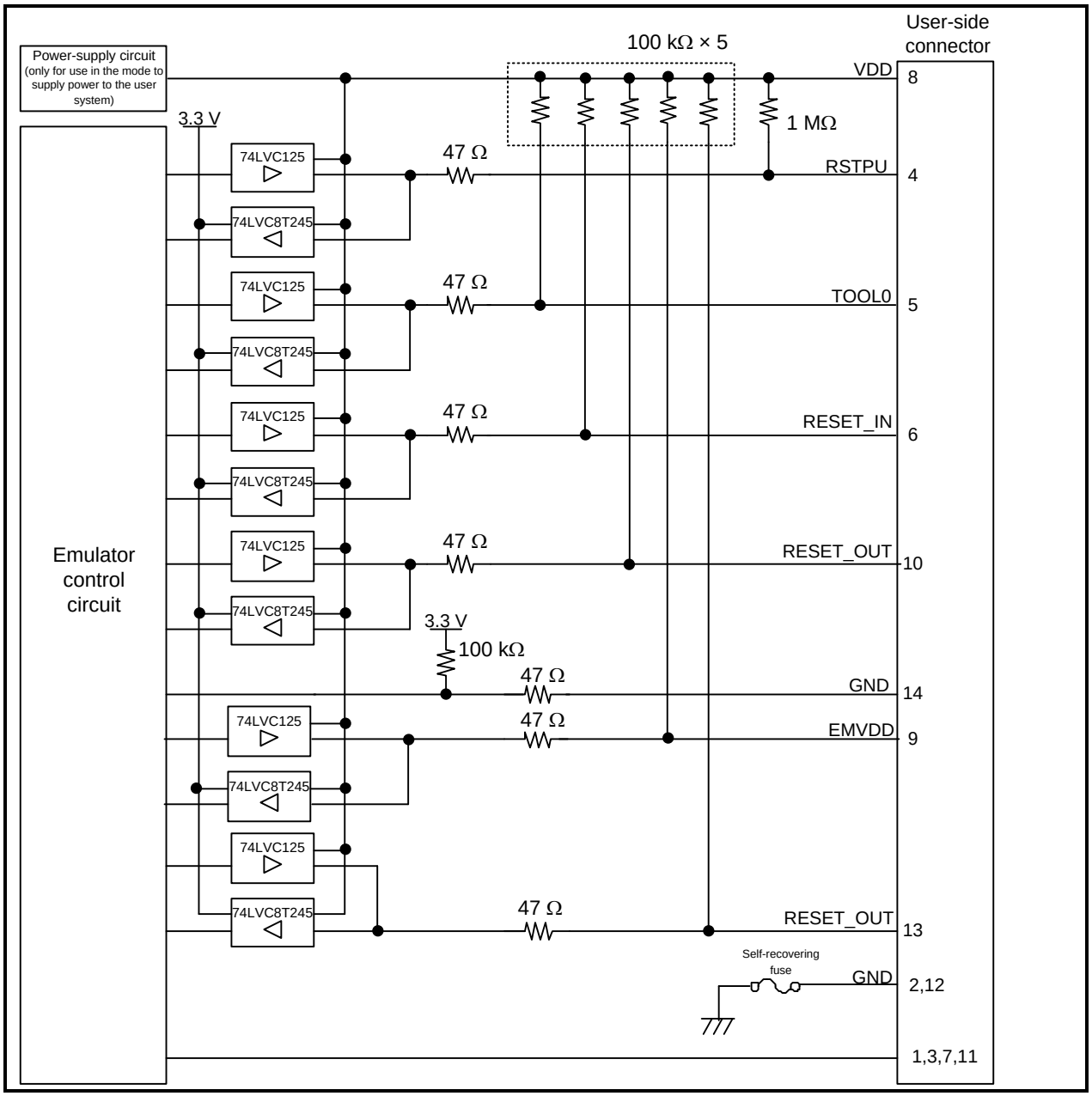


Figure 2-10 Internal Circuits of the E2 Lite (when the RL78 Family is Connected)

2.7. Notes on Designing the User System

2.7.1. Isolators for the E1 and E20

For a debugging environment where there is a difference in potential between the GND of the user system and that of the host PC, use the isolator for the E1 emulator (R0E000010ACB20) which is separately available from Renesas.
That is, use the isolator for the E1 (R0E000010ACB20) with the E2 Lite in such situations.
The isolator for the E1 (R0E000010ACB20) must also be used for the E2 Lite.

2.7.2. Low-Voltage OCD Board

Since the RL78-S1 core device needs 4.5 V to 5.5 V as the voltage for rewriting flash memory, if the voltage is less than 4.5 V, the debugging functions that require flash memory to be rewritten (e.g., program download) cannot be operated. When debugging with a voltage less than 4.5 V, the low-voltage OCD board (R0E510Y47LVB00 or R0E510Y16LVB00) which is sold separately must be prepared. For details on the low-voltage OCD board, refer to the user's manual.

2.7.3. Small Connector Conversion Adapter for the E1

A small connector conversion adapter for the E1 (R0E000010CKZ11) is separately available from Renesas for user system boards which are too small to mount the 14-pin connector that is the standard connector for the E1 and E2 Lite. By using the adapter, you can reduce the area taken up by the connector mounted on your system.
However, when you use the small connector conversion adapter for the E1, be aware that the pin assignments of the connector differ from those of the standard interface connector for the E1 and E2 Lite. The pin assignments on the 14-pin connector when the small connector conversion adapter for the E1 is used are shown in Table 2-4.
The small connector conversion adapter for the E1 can also be used with the E2 Lite.

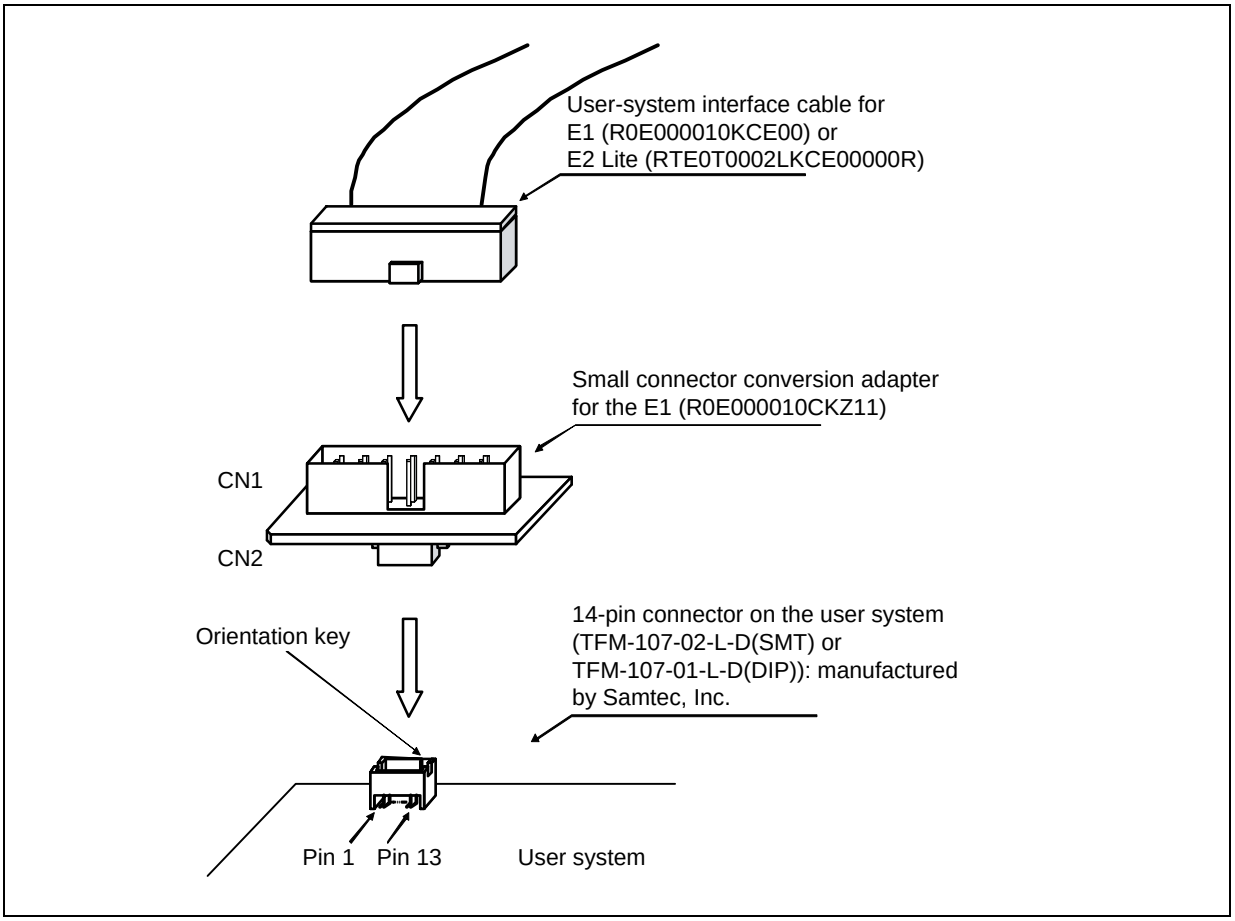


Figure 2-11 Usage of the Small Connector Conversion Adapter for the E1

Table 2-4 Connector Pin Assignments when the Small Connector Conversion Adapter for the E1 is Used

Pin No.	RL78/G10 Signal *1 *2	Direction *3	Note
1	GND *4	—	
2	R.F.U *6	—	
3	VDD	—	
4	R.F.U *6	—	
5	RESET_OUT *5	Input	This pin is used to output a reset signal to the target device.
6	GND *4	—	
7	RESET_OUT *5	Input	This pin is used to output a reset signal to the target device.
8	R.F.U *6	—	
9	R.F.U *6	—	
10	TOOL0	I/O	This pin is used to transmit command/data to the target device.
11	R.F.U *6	—	This pin is used to pull up the reset line.
12	RESET_IN	Output	This pin is used to input a reset signal from the user system.
13	EMVDD *7	—	
14	GND *4	—	

*1 For details on the programming software, refer to:
http://www.renesas.com/products/tools/flash_prom_programming/

*2 These are the names of the MCU pins at the time the E1/E20/E2 Lite is connected (i.e. during debugging).

*3 Input to or output from the user system.

*4 Securely connect pins 1, 6, and 14 of the connector to GND of the user system. These pins are used for electrical grounding as well as for monitoring of connection with the user system by the E1/E20/E2 Lite.

*5 Securely connect both pin 5 and pin 7.

*6 This pin is reserved. Perform the open processing.

*7 Connect VDD.

3. Notes on Usage

3.1. Turning the Power On/Off

Turn on or off the power of the E1/E20/E2 Lite and the user system following the procedure below.

3.1.1. When a Separate Power Supply is Used for the User System

<When using the emulator>

(1) Check that the power is off.
Check that the user system is turned off. When using the E20, check that its power switch is off.

(2) Connect the user system.
Connect the emulator and the user system with a user system interface cable.

(3) Connect the host machine and turn on the emulator.
Connect the emulator and the host machine with a USB interface cable. The E1/E2 Lite is turned on by connecting the USB interface cable. When using the E20, turn on its power switch.

(4) Launch the emulator debugger or programming software.
Launch the emulator debugger or programming software.

(5) Turn on the user system.
Turn on the user system.

(6) Launch the emulator debugger or connect the programming software to the emulator.
Connections may vary depending on software.

<When finished using the emulator>

(1) Close the emulator debugger or disconnect the emulator from the programming software.
Disconnections may vary depending on software.

(2) Turn off the user system.
Turn off the user system.

(3) Close the emulator debugger or the programming software.
Close the emulator debugger or the programming software.

(4) Turn off the emulator and disconnect the emulator.
When using the E20, turn off its power switch. Disconnect the USB interface cable from the E1/E2 Lite. The E1/E2 Lite is turned off by disconnecting the USB interface cable.

(5) Disconnect the user system.
Disconnect the user system interface cable from the user system.

CAUTION

Notes on the User System Power Supply:

While the power of the user system is on, do not turn off the host machine, unplug the USB interface cable, or turn off the power switch of the E20.
The user system may be damaged due to current leakages.

3.1.2. When Power is Supplied to the User System from the Emulator (E1 Only)

<When using the emulator>

(1) Connect the user system.
Connect the emulator and the user system with a user system interface cable.

(2) Connect the host machine and turn on the emulator.
Connect the emulator and the host machine with a USB interface cable, then turn on the emulator.

(3) Launch the emulator debugger or programming software.
Launch the emulator debugger or programming software and select the setting of power supply to the user system.

(4) Connect the emulator debugger or programming software to the emulator.
Connections may vary depending on software.

<When finished using the emulator>

(1) Disconnect the emulator debugger or programming software from the emulator.
Disconnections may vary depending on software.

(2) Close the emulator debugger or programming software.
Close the emulator debugger or programming software.

(3) Turn off the emulator and disconnect the emulator.
Disconnect the USB interface cable from the emulator, then turn off the emulator.

(4) Disconnect the user system.
Disconnect the user system interface cable from the user system.

3.2. Power Supply Function of the E1/E2 Lite

When using the power supply function of the E1/E2 Lite, check that the voltage is supplied to the user system. Particularly, when the 5.0-V supply option is selected, the voltage may drop 0.5 V or more since it depends on the USB VBUS power-supply voltage. Note that the E2 Lite supports power supply of 3.3 V only.

3.3. MCU Resources to be Occupied

Figure 3-1 shows the areas which are occupied by the E1/E20/E2 Lite for debugging.
These areas (shaded sections) are used for debugging. These areas should not be changed to save the user program or data. If a change is made, control by the E1/E20/E2 Lite is no longer possible.

However, when "No" is selected in the [Permit flash programming] property of the debugger, the internal ROM space shown in Figure 3-1 is not used (only the internal RAM space is used).
When selecting not to permit flash memory rewriting with the debugger's property, also refer to section 3.3.3, Setting of On-Chip Debugging Option Byte.

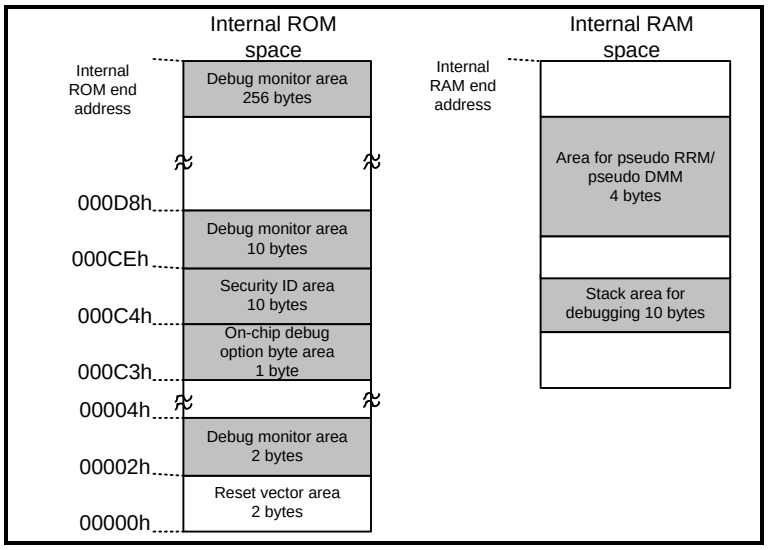


Figure 3-1 MCU Resources to be Occupied

*1	The reset vector area is used by the program for the E1/E20/E2 Lite when performing debugging with the E1/E20/E2 Lite. If the contents of the reset vector area are changed, control by the E1/E20/E2 Lite is no longer possible.

3.3.1. Securing an Area for the Debugging Monitor Program

You may need to secure the area to which the debugging monitor program is to be allocated. The monitor program initializes the debugger communications interface and handles processing to make the CPU run or break execution.

This user program or data must not be placed within 23 bytes of the on-chip debugging option byte.

In addition, the reset vector must be changed if it points to an address to which the monitor program is allocated.

[Securing the area]

Specifically securing the area for the monitor program is not necessarily required if the user program does not use the area.

However, to avoid problems that may occur while the debugger is starting up, we recommend securing this area in advance by using a build tool or some other means.

3.3.2. Securing a Stack Area for Debugging

The debugger requires 10 bytes as a stack area for debugging. Since this area is allocated immediately after the stack area, the address of this area varies depending on the stack increase and decrease. That is, 10 extra bytes are consumed for the stack area used.

Make sure the stack area for debugging does not exceed the range of the internal RAM space.

Figure 3-2 shows an example in which the stack area has increased with the start address of the internal RAM space being 0xFFE60.

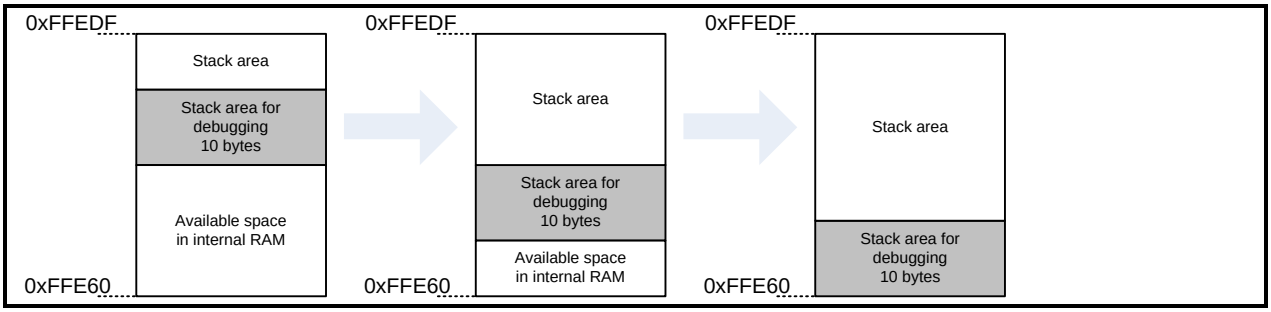


Figure 3-2 Variation of Address of Stack Area for Debugging

3.3.3. Setting an On-Chip Debugging Option Byte

This is the area for the security setting to prevent the flash memory from being read by an unauthorized person.
For settable values, refer to the user's manual for each MCU.

[Setting an on-chip debugging option byte] *1
Set the on-chip debugging option byte in either of the following ways.

(a) Embed the on-chip debugging option byte at address 0xC3 in the user program.
Embed the on-chip debugging option byte at address 0xC3 in the user program.

(b) Set the on-chip debugging option byte by the build tool.
For details on the setting method, refer to the user's manual for the build tool.

*1 If the value of the on-chip debugging option byte set in the device disables on-chip debugging (OCDENSET = 0), the debugger cannot be started when "No" is selected in the [Permit flash programming] property of the debugger. If a setting to enable flash programming is made, though the debugger can be started, the flash memory will be in an erased state when the debugger is started.

3.3.4. Setting a Security ID

This setting is required to prevent the memory from being read by an unauthorized person. Embed a security ID at addresses 0xC4 to 0xCD in the internal flash memory.

The debugger starts only when the security ID that is set during debugger startup and the security ID set at addresses 0xC4 to 0xCD match. If the ID codes do not match, the debugger manipulates the target device in accordance with the value set to the on-chip debug option byte area (refer to the hardware manual for each MCU).

If the user has forgotten the security ID to enable debugging, erase the flash memory and set the security ID again.

Set the security ID in either of the following ways. When both methods (a) and (b) are carried out at the same time, method (b) has priority.

(a) Embed the security ID at addresses 0xC4 to 0xCD in the user program.
For example if the security ID is embedded as follows, the security ID set by the debugger is ″0123456789ABCDEF1234″ (not case-sensitive). Note 1, Note 2

(b) Set the security ID by common options of the build tool.
For details on the setting method, refer to the user's manual for the build tool.

Table 3-1 Example of Security ID Setting

Address	Value
0x000C4	0x01
0x000C5	0x23
0x000C6	0x45
0x000C7	0x67
0x000C8	0x89
0x000C9	0xAB
0x000CA	0xCD
0x000CB	0xEF
0x000CC	0x12
0x000CD	0x34

Notes: 1 When connecting a debugger to a device for which the security ID has been set, the security ID needs to be entered in the debugger. For details on the authentication method, refer to the user's manual for the debugger in use.
2 "0xFFFFFFFFFFFFFFFFFFFF" which is a setting of only "0xFF" cannot be set.

3.3.5. Area for Pseudo-RRM/Pseudo-DMM

To use the pseudo-RRM/pseudo-DMM function in the RL78-S1 core device, a part (4 bytes) of the RAM area is used for the pseudo-RRM/pseudo-DMM function. Information, such as whether this area can be allocated by the build tool, can be confirmed in the user's manual for the build tool.

3.4. Reset

3.4.1. Operation after a Reset

After an external pin reset or internal reset, the monitor program performs debug initialization processing. Consequently, the time from reset occurrence until user program execution differs from that in the actual device operation. If “No” is selected in Permit flash programming in property of the debug tool, the time until the user program is executed compared with the time when “Yes” is selected is delayed by several 100 ms.

3.4.2. SP Value after a Reset

While debugging with the E1/E20/E2 Lite, the SP value after a reset becomes as follows:

- FED0

3.5. Flash Memory

3.5.1. Operation for Voltages Not Permitting Flash Memory Rewriting

When a voltage with which rewriting or erasure of flash memory cannot be performed has been selected or flash programming has been disabled with the debugger's property, the debugger operations that rewrite flash memory will cause an error in the debugger and the operations will be invalidated.

3.5.2. Notes on Flash Memory Rewriting

In the RL78-S1 core device, a pin reset is always necessary for rewriting of flash memory. For this reason, a pin reset always occurs at debugger operations (download, rewriting of flash memory from a memory window, etc.) that accompany rewriting of flash memory.

Since a part of the RAM area (0FFEC6h to 0FFECFh) is used by the E1/E20/E2 Lite at rewriting of flash memory, the RAM data will be rewritten.

3.6. MCUs that are Used in Debugging

3.6.1. Usage in Mass-Production

MCUs that are connected to the E1/E20/E2 Lite and used in debugging are placed under stress by repeated programming of flash memory during emulation. Do not use MCUs that were used in debugging in mass-production for end users.

3.7. Final Evaluation of the User Program

Before entering the mass-production phase, be sure to perform a final evaluation of the program which is written to flash ROM by the Renesas Flash Programmer, PG-FP5, etc. Be sure to perform the evaluation singly, without the E1/E20/E2 Lite connected.

3.8. Debug Functions

3.8.1. Step Execution

(1) Cautions on using step-in (step execution)
The value of some SFRs (special function registers) might remain unchanged while stepping into code. If the values of the SFRs do not change while stepping into code, operate the microcontroller by continuously executing the instructions instead of executing them in steps.

Stepping into code: Instructions in the user-created program are executed one by one.
Continuous execution: The user-created program is executed from the current PC value.

3.8.2. [Go to Here]

If [Go to Here] is selected, event breakpoints that have been set so far will be temporarily invalidated.

3.8.3. Debugging in Standby Mode

The break is an interrupt function of the CPU. Standby mode is released by the break generated by using the following debugging functions.

<1> Forced break
<2> Step execution of the standby instruction (Stops the user program after execution instruction)
<3> Short break generated by the pseudo-RRM function (Break When Readout)
<4> Short break generated by the pseudo-DMM function (Break When Write)
<5> Short break generated by setting a breakpoint while executing the user program

3.8.4. Pseudo-Real-Time RAM Monitor Function or Pseudo-Dynamic Memory Modification Function

Note the following points when using the pseudo-real-time RAM monitor (RMM) function or the pseudo-Dynamic Memory Modification (DMM) function.

- Standby mode (HALT or STOP) may be cancelled during monitoring.
- The pseudo-RRM function or the pseudo-DMM function does not operate while the CPU operating clock is stopped.
- When the number of monitoring points is numerous, the response of the debugger becomes slow.
- Influence of the debugger response becomes small by using a watch panel instead of a memory panel.
- Four bytes of the RAM area are used when the pseudo-RRM and pseudo-DMM functions are used. The RAM area to be used when using the pseudo-RRM and pseudo-DMM functions should be set by the build tool.
  (For details on setting the area, refer to the user's manual for the build tool.)
  If no area is set, the four bytes at the beginning of the RAM area will be used.

3.8.5. Software Break Function

The RL78-S1 core device does not have the software break function. The hardware break function can be used alternatively but a break will occur several instructions after the breakpoint because the hardware break function generates a break after execution of the instruction at the breakpoint. Note that if a branch occurs between the breakpoint and the point where program execution stops, the break appears to have not occurred at the breakpoint in some cases.

E1/E20 Emulator, E2 Emulator Lite
Additional Document for User's Manual
(Notes on Connection of RL78)

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